

CLAIMS

What is claimed is:

1. A flavoring system for food products, said system comprising a sulfury-cheddar flavor component, a cheesy flavor component and a creamy-buttery component,

wherein the sulfury-cheddar flavor component is prepared by treating a first dairy product containing an aqueous protein source and fat source combination with lipase and a lactic acid culture at a temperature of about 15 to about 35°C for about 10 to about 72 hours to obtain a first mixture having a pH of about 5.8 or less; adjusting the pH of the first mixture to about 6 or higher to obtain a second mixture; treating the second mixture with a sulfur-containing substrate, and a microorganism that can convert the sulfur-containing substrate to sulfur-containing flavor compounds, and optionally a first bacterocin source, at a temperature of about 15 to about 35°C for about 12 to about 96 hours to obtain a third mixture; heating the third mixture at a temperature sufficient to inactivate the cultures and enzymes in the third mixture to form the sulfury-cheddar flavor component;

wherein the cheesy flavor component is prepared by treating a second dairy product containing an aqueous protein source and fat source combination with a lactic acid culture at a temperature of about 15 to about 45°C for about 10 to about 24 hours to obtain a fourth mixture; treating the fourth mixture with a lipase, a protease, and an aminopeptidase, and optionally a second bacterocin source, at a temperature of about 20 to about 50°C for about 16 to about 96 hours to obtain a fifth mixture; treating the fifth mixture at a temperature sufficient to inactivate the cultures and enzymes in the fifth mixture to form the cheesy flavor component;

wherein the creamy-buttery flavor component is prepared by treating a third dairy product containing an aqueous protein source and fat source combination with a lactic acid culture at a temperature of about 20 to about

35°C for about 10 to about 24 hours to obtain a sixth mixture having a pH of about 5.4 or less; treating the sixth mixture with a diacetyl-producing flavor culture, and optionally a third bacterocin source, at a temperature of about 20 to about 35°C for about 16 to about 240 hours to obtain a seventh mixture; heating the seventh mixture at a temperature sufficient to inactivate the cultures and enzymes in the seventh mixture to form the creamy-buttery flavor component;

wherein at least one of the first, second, and third bacterocin sources is included, and wherein the sulfury-cheddar component, the cheesy component and the creamy-butter component of the flavoring system can be incorporated in varying amounts into food products to produce a variety of flavors.

2. The flavoring system of claim 1, wherein the at least one of the first, second, and third bacterocin sources included each comprise nisin.

3. The flavoring system of claim 1, wherein the at least one of the first, second, and third bacterocin sources included independently are selected from the group consisting of nisin A, nisin Z, pediocin, lactosin, lactacins, carnocin, enterocin, plantaricin, subtilin, epidermin, cinnamycin, duramycin, and ancovenin, individually or in any combination thereof.

4. The flavoring system of claim 1, wherein the at least one of the first, second, and third bacterocin sources included comprises a bacterocin-producing culture.

5. The flavoring system of claim 1, wherein the first and second bacterocin sources are included and independently comprise nisin, wherein nisin is present in a first amount of about 50 to about 500 IU/g in the third mixture, and nisin is present in a second amount of about 50 to about 500 IU/g in the fifth mixture.

6. The flavoring system of claim 1, wherein the lactic acid culture used to prepare the sulfury-cheddar flavor component is *Lactococcus lactis* and *Lactococcus lactis* ssp. *cremoris*; and wherein the lipase used to prepare the cheesy flavor component is a fungal lipase, the protease used to prepare the cheesy flavor component is a neutral bacterial protease, a fungal protease, or mixtures thereof, and the aminopeptidase used to prepare the cheesy flavor component is *Lactobacillus helveticus*.

7. The flavoring system of claim 1, wherein the first, second and third dairy products are independently selected from a milk concentrate, a milk substrate, a whey concentrate, a whey substrate, individually or in a combination thereof.

8. The flavoring system of claim 1, wherein the sulfur-containing substrate is L-methionine, L-glutathione, and L-cysteine, or mixtures thereof.

9. The flavoring system of claim 1, wherein the first bacterocin source is included.

10. The flavoring system of claim 1, wherein the second bacterocin source is included.

11. The flavoring system of claim 1, wherein at least one of the first, second, and third bacterocin sources is used in combination with a secondary antimicrobial agent.

12. A food product comprising a cultured cheese concentrate, said cultured cheese concentrate comprising a sulfury-cheddar component, a cheesy component, and a creamy-buttery component,

wherein the sulfury-cheddar component is prepared by treating a first dairy product containing an aqueous protein source and fat source

combination with lipase and a lactic acid culture at a temperature of about 15 to about 35°C for about 10 to about 72 hours to obtain a first mixture having a pH of about 5.8 or less; adjusting the pH of the first mixture to about 6 or higher to obtain a second mixture; treating the second mixture with a sulfur-containing substrate, and a microorganism that can convert the sulfur-containing substrate to sulfur-containing flavor compounds, and optionally a first bacterocin source, at a temperature of about 15 to about 35°C for about 12 to about 96 hours to obtain a third mixture; heating the third mixture at a temperature sufficient to inactivate the cultures and enzymes in the third mixture to form the sulfury-cheddar component;

wherein the cheesy component is prepared by treating a second dairy product containing an aqueous protein source and fat source combination with a lipase and a peptidase at a temperature of about 20 to about 45°C for about 10 to about 24 hours to obtain a fourth mixture; treating the fourth mixture with a lipase, a protease, and an aminopeptidase, and optionally a second bacterocin source, at a temperature of about 20 to about 50°C for about 16 to about 96 hours to obtain a fifth mixture; treating the fifth mixture at a temperature sufficient to inactivate the cultures and enzymes in the fifth mixture to form the cheesy component;

wherein the creamy-buttery flavor component is prepared by treating a third dairy product containing an aqueous protein source and fat source combination with a lactic acid culture at a temperature of about 20 to about 35°C for about 10 to about 24 hours to obtain a sixth mixture having a pH of about 5.4 or less; treating the sixth mixture with a diacetyl-producing flavor culture, and optionally a third bacterocin source, at a temperature of about 20 to about 35°C for about 16 to about 240 hours to obtain a seventh mixture; heating the seventh mixture at a temperature sufficient to inactivate the cultures and enzymes in the seventh mixture to form the creamy-buttery component;

wherein at least one of the first, second, and third bacterocin sources is included.

13. The food product of claim 12, wherein said food product comprises about 1 to about 10 weight percent said cultured cheese concentrate, and said cultured cheese concentrate comprises 1 to about 80 percent of the sulfury-cheddar component, about 10 to about 90 percent of the cheesy component, and about 10 to about 90 percent of the creamy-buttery component.

14. The food product of claim 13, wherein said food product comprises about 1 to about 10 weight percent said cultured cheese concentrate, and said cultured cheese concentrate comprises 25 to about 75 percent of the sulfury-cheddar component, about 25 to about 75 percent of the cheesy component, and about 25 to about 75 percent of the creamy-buttery component.

15. The food product of claim 13, wherein the food product comprises a cheese base.

16. The food product of claim 12, wherein the food product comprises a cheese base selected from process cheese, natural cheese, cream cheese, or cottage cheese.

17. The food product of claim 12, wherein the at least one of the first, second and third bacterocin sources included each comprise nisin.

18. The food product of claim 12, wherein the at least one of the first, second, and third bacterocin sources included independently are selected from the group consisting of nisin A, nisin Z, pediocin, lactosin, lactacins, carnocin, enterocin, plantaricin, subtilin, epidermin, cinnamycin, duramycin, and ancovenin, individually or in any combination thereof.

19. The food product of claim 12, wherein the at least one of the first, second, or third bacterocin sources included comprises a bacterocin-producing culture.

20. The food product of claim 12, wherein the first and second bacterocin sources are included and independently comprise nisin, wherein nisin is present in a first amount of about 50 to about 500 IU/g in the third mixture, and nisin is present in a second amount of about 50 to about 500 IU/g in the fifth mixture.

21. The food product of claim 12, wherein the lactic acid culture used to prepare the sulfury-cheddar flavor component is *Lactococcus lactis* and *Lactococcus lactis* ssp. *cremoris*; and wherein the lipase used to prepare the cheesy flavor component is a fungal lipase, the protease used to prepare the cheesy flavor component is a neutral bacterial protease, a fungal protease, or mixtures thereof, and the aminopeptidase used to prepare the cheesy flavor component is *Lactobacillus helveticus*.

22. The food product of claim 12, wherein the first, second and third dairy products are independently selected from a milk concentrate, a milk substrate, a whey concentrate, a whey substrate, individually or in a combination thereof.

23. The food product of claim 12, wherein the sulfur-containing substrate is L-methionine, L-glutathione, and L-cysteine, or mixtures thereof.

24. The food product of claim 12, wherein the first bacterocin source is included.

25. The food product of claim 12, wherein the second bacterocin source is included.

26. The food product of claim 12, wherein at least one of the first, second, and third bacterocin sources is used in combination with a secondary antimicrobial agent.

27. A sulfury-cheddar flavor component, wherein the sulfury-cheddar flavor component is prepared by a process comprising treating a first dairy product containing an aqueous protein source and fat source combination with lipase and a lactic acid culture at a temperature of about 15 to about 35°C for about 10 to about 72 hours to obtain a first mixture having a pH of about 5.8 or less; adjusting the pH of the first mixture to about 6 or higher to obtain a second mixture; treating the second mixture with a bacterocin source, a sulfur-containing substrate, and a microorganism that can convert the sulfur-containing substrate to sulfur-containing flavor compounds, at a temperature of about 15 to about 35°C for about 12 to about 96 hours to obtain a third mixture; heating the third mixture at a temperature sufficient to inactivate the cultures and enzymes in the third mixture to form the sulfury-cheddar flavor component.

28. The sulfury-cheddar flavor component of claim 27, wherein the treating of the first dairy product, lipase and lactic acid culture is conducted over a period of time of about 12 to about 24 hours; and wherein the treating of the second mixture is conducted over a period of time of about 38 to about 50 hours.

29. The sulfury-cheddar flavor component of claim 27, wherein the sulfury-cheddar flavor component is a dried powder.

30. A cheesy flavor component, wherein the cheesy component is prepared by a process comprising treating a second dairy product containing an aqueous protein source and fat source combination with a lactic acid culture at a temperature of about 15 to about 45°C for about 10 to about 24

hours to obtain a fourth mixture; treating the fourth mixture with a lipase, a protease, an aminopeptidase, and a second bacterocin source, at a temperature of about 20 to about 50°C for about 16 to about 96 hours to obtain a fifth mixture; treating the fifth mixture at a temperature sufficient to inactivate the cultures and enzymes in the fifth mixture to form the cheesy flavor component.

31. The cheesy flavor component of claim 30, wherein the cheesy flavor component is a dried powder.

32. A creamy-buttery flavor component, wherein the creamy-buttery flavor component is prepared by a process comprising treating a third dairy product containing an aqueous protein source and fat source combination with a lactic acid culture at a temperature of about 20 to about 35°C for about 10 to about 24 hours to obtain a sixth mixture having a pH of about 5.4 or less; treating the sixth mixture with a diacetyl-producing flavor culture, and optionally a third bacterocin source, at a temperature of about 20 to about 35°C for about 16 to about 240 hours to obtain a seventh mixture; heating the seventh mixture at a temperature sufficient to inactivate the cultures and enzymes in the seventh mixture to form the creamy-buttery flavor component.

33. The creamy-buttery flavor component of claim 32, wherein the creamy-buttery flavor component is a dried powder.

34. A method for preparing a flavored cheese using a cultured cheese concentrate, said method comprising:

- 1) preparing a cheese or dairy base; and
 - 2) incorporating about 1 to about 10 percent of a cultured cheese concentrate into the cheese or dairy base to form the flavored cheese;
- wherein the cultured cheese concentrate comprises 1 to about 80 percent of the sulfury-cheddar component, about 10 to about 90 percent of

the cheesy component, and about 10 to about 90 percent of the creamy-buttery component; and

wherein the sulfury-cheddar component is prepared by treating a first dairy product containing an aqueous protein source and fat source combination with lipase and a lactic acid culture at a temperature of about 15 to about 35°C for about 10 to about 72 hours to obtain a first mixture having a pH of about 5.8 or less; adjusting the pH of the first mixture to about 6 or higher to obtain a second mixture; treating the second mixture with a sulfur-containing substrate, and a microorganism that can convert the sulfur-containing substrate to sulfur-containing flavor compounds, and optionally a first bacterocin source, at a temperature of about 15 to about 35°C for about 12 to about 96 hours to obtain a third mixture; heating the third mixture at a temperature sufficient to inactivate the cultures and enzymes in the third mixture to form a sulfury-cheddar component;

wherein the cheesy component is prepared by treating a second dairy product containing an aqueous protein source and fat source combination with a lipase and a peptidase at a temperature of about 20 to about 45°C for about 10 to about 24 hours to obtain a fourth mixture; treating the fourth mixture with a lipase, a protease, and an aminopeptidase, and optionally a second bacterocin source, at a temperature of about 20 to about 50°C for about 16 to about 96 hours to obtain a fifth mixture; treating the fifth mixture at a temperature sufficient to inactivate the cultures and enzymes in the fifth mixture to form a cheesy component;

wherein the creamy-buttery flavor component is prepared by treating a third dairy product containing an aqueous protein source and fat source combination with a lactic acid culture at a temperature of about 20 to about 35°C for about 10 to about 24 hours to obtain a sixth mixture having a pH of about 5.4 or less; treating the sixth mixture with a diacetyl-producing flavor culture, and optionally a third bacterocin source, at a temperature of about 20 to about 35°C for about 16 to about 240 hours to obtain a seventh mixture; heating the seventh mixture at a temperature sufficient to inactivate the

cultures and enzymes in the seventh mixture to form a creamy-buttery component;

wherein at least one of the first, second, and third bacterocin sources is included.

35. The method of claim 34, wherein the cheese or dairy base is selected from process cheese, natural cheese, cream cheese, or cottage cheese.

36. The method of claim 34, wherein the at least one of the first, second, and third bacterocin sources included each comprise nisin.

37. The method of claim 34, wherein the at least one of the first, second, and third bacterocin sources included independently are selected from the group consisting of nisin A, nisin Z, pediocin, lactosin, lactacins, carnocin, enterocin, plantaricin, subtilin, epidermin, cinnamycin, duramycin, and ancovenin, individually or in any combination thereof.

38. The method of claim 34, wherein the at least one of the first, second, and third bacterocin sources included comprises a bacterocin-producing culture.

39. The method of claim 34, wherein the first and second bacterocin sources are included and independently comprise nisin, wherein nisin is present in a first amount of about 50 to about 500 IU/g in the third mixture, and nisin is present in a second amount of about 50 to about 500 IU/g in the fifth mixture.

40. The method of claim 34, wherein the lactic acid culture used to prepare the sulfury-cheddar flavor component is *Lactococcus lactis* and *Lactococcus lactis* ssp. *cremoris*; and wherein the lipase used to prepare the

cheesy flavor component is a fungal lipase, the peptidase used to prepare the cheesy flavor component is *Lactobacillus helveticus*, the protease used to prepare the cheesy flavor component is a neutral bacterial protease, a fungal protease, or mixtures thereof, and the aminopeptidase used to prepare the cheesy flavor component is *Lactobacillus helveticus*.

41. The method of claim 34, wherein the cultured cheese concentrate is a dried powder.

42. The method of claim 34, wherein the first bacterocin source is included.

43. The method of claim 34, wherein at least one of the first, second, and third bacterocin sources is used in combination with a secondary antimicrobial agent.

44. A method for preparing a flavored cheese using a cultured cheese concentrate, said method comprising:

- a) preparing a milk substrate suitable for producing a cheese;
- b) incorporating about 1 to about 10 percent by weight of the cultured cheese concentrate into the milk substrate;
- c) treating the milk substrate and cultured cheese concentrate to set the milk substrate;
- d) cutting the set milk substrate to form curds and whey;
- e) cooking the curds and whey;
- f) separating the curds and whey; and
- g) forming the flavored cheese from the separated curds;

wherein the cultured cheese concentrate comprises 1 to about 80 percent of a sulfury-cheddar component, about 10 to about 90 percent of a cheesy component, and about 10 to about 90 percent of a creamy-buttery component; and

wherein the sulfury-cheddar component is prepared by treating a first dairy product containing an aqueous protein source and fat source combination with lipase and a lactic acid culture at a temperature of about 15 to about 35°C for about 10 to about 72 hours to obtain a first mixture having a pH of about 5.8 or less; adjusting the pH of the first mixture to about 6 or higher to obtain a second mixture; treating the second mixture with a sulfur-containing substrate, and microorganism that can convert the sulfur-containing substrate to sulfur-containing flavor compounds (e.g., a *Brevibacterium linens* culture or a yeast from the genera *Debaryomyces* or *Kluyveromyces*), and optionally a first bacterocin source, at a temperature of about 15 to about 35°C for about 12 to about 96 hours to obtain a third mixture; heating the third mixture at a temperature sufficient to inactivate the cultures and enzymes in the third mixture to form the sulfury-cheddar component;

wherein the cheesy component is prepared by treating a second dairy product containing an aqueous protein source and fat source combination with a lipase and a peptidase at a temperature of about 20 to about 45°C for about 10 to about 24 hours to obtain a fourth mixture; treating the fourth mixture with a lipase, a protease, and an aminopeptidase, and optionally a second bacterocin source, at a temperature of about 20 to about 50°C for about 16 to about 96 hours to obtain a fifth mixture; treating the fifth mixture at a temperature sufficient to inactivate the cultures and enzymes in the fifth mixture to form the cheesy component;

wherein the creamy-buttery flavor component is prepared by treating a third dairy product containing an aqueous protein source and fat source combination with a lactic acid culture at a temperature of about 20 to about 35°C for about 10 to about 24 hours to obtain a sixth mixture having a pH of about 5.4 or less; treating the sixth mixture with a diacetyl-producing flavor culture, and optionally a third bacterocin source, at a temperature of about 20 to about 35°C for about 16 to about 240 hours to obtain a seventh mixture; heating the seventh mixture at a temperature sufficient to inactivate the

cultures and enzymes in the seventh mixture to form the creamy-buttery component;

wherein at least one of the first, second, and third bacterocin sources is included.

45. The method of claim 44, wherein the at least one of the first, second, and third bacterocin sources included each comprise nisin.

46. The method of claim 44, wherein the at least one of the first, second, or third bacterocin sources included independently are selected from the group consisting of nisin A, nisin Z, pediocin, lactosin, lactacins, carnocin, enterocin, plantaricin, subtilin, epidermin, cinnamycin, duramycin, and ancovenin, individually or in any combination thereof.

47. The method of claim 44, wherein the at least one of first, second, and third bacterocin sources included comprises a bacterocin-producing culture.

48. The method of claim 44, wherein the first and second bacterocin sources are included and independently comprise nisin, wherein nisin is present in a first amount of about 50 to about 500 IU/g in the third mixture, and nisin is present in a second amount of about 50 to about 500 IU/g in the fifth mixture.

49. The method of claim 44, wherein the lactic acid culture used to prepare the sulfury-cheddar flavor component is *Lactococcus lactis* and *Lactococcus lactis* ssp. *cremoris*; and wherein the lipase used to prepare the cheesy flavor component is a fungal lipase, the peptidase used to prepare the cheesy flavor component is *Lactobacillus helveticus*, the protease used to prepare the cheesy flavor component is a neutral bacterial protease, a fungal

protease, or mixtures thereof, and the aminopeptidase used to prepare the cheesy flavor component is *Lactobacillus helveticus*.

50. The method of claim 44, wherein the cultured cheese concentrate is a dried powder.

51. The method of claim 44, wherein the first bacterocin source is included.

52. The method of claim 44, wherein at least one of the first, second, and third bacterocin sources is used in combination with a secondary antimicrobial agent.